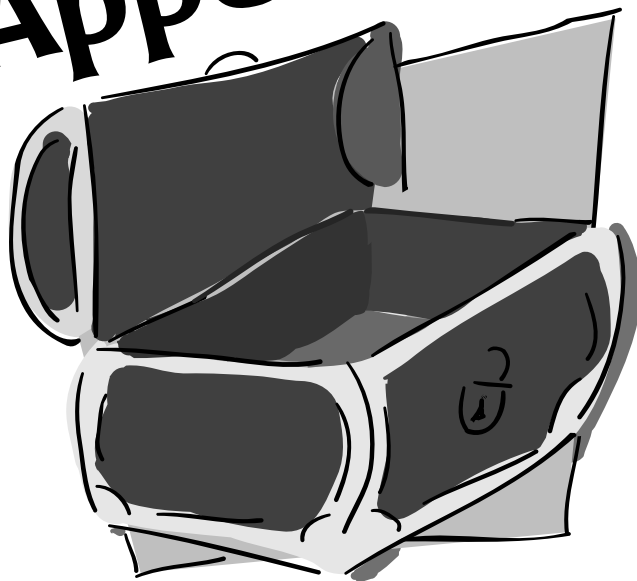


Appendix



Site Definition Sheet

Integrated 1-Day Data Sheet

Integrated 7-Day Data Sheet

Ozone Data Sheet

Aerosol Data Sheet

Clouds 7-Measurement Data Sheet

Maximum/Minimum Thermometer Work Sheet

Observing Cloud Type

Glossary

Atmosphere Investigation

Site Definition Sheet

School Name: _____ Class or Group Name: _____

Name(s) of student(s) filling in Site Definition Sheet: _____

Date: _____ Check one: ☐ New Site ☐ Metadata Update

Site name (give your site a unique name): _____

Coordinates: Latitude: _____ ☐ N or ☐ S Longitude: _____ ☐ E or ☐ W

Elevation: _____ meter

Source of Location Data (check one): ☐ GPS ☐ Other _____

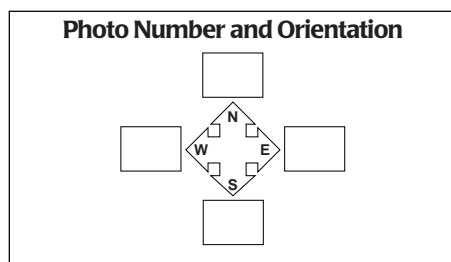
Obstacles (Check one): ☐ No obstacles ☐ Obstacles (describe below)

(Obstacles are trees, buildings, etc. that appear above 14° elevation when viewed from the site.)

Description: _____

Buildings within 10 meters of your instrument shelter (Check one): ☐ No buildings ☐ Buildings (describe below)

Description: _____



Other Site Data:

Steepest Slope: _____ Compass Angle (facing up slope): _____

Height of the top of the rain gauge: _____ cm

Height of the bulb of your max/min thermometer: _____ cm

Height of the clip in your ozone measurement station: _____ cm

Surface Cover under instrument shelter (Check one): ☐ Pavement ☐ Bare ground

☐ Short grass (< 10 cm) ☐ Long grass (> 10 cm) ☐ Sand ☐ Roof (describe below)

☐ Other (describe below)

Description: _____

Overall comments on the site (metadata): _____

Atmosphere Investigation

Integrated 1-Day Data Sheet

School Name: _____

Observer names: _____

Date: Year_____ Month_____ Day_____ Study Site: ATM-_____

Local time (hour:min):_____ Universal time (hour:min): _____

Cloud Type (Check all types seen)

High:	<input type="checkbox"/> Cirrostratus	<input type="checkbox"/> Cirrus	<input type="checkbox"/> Cirrocumulus
Middle:	<input type="checkbox"/> Altostratus	<input type="checkbox"/> Altopumulus	
Low:	<input type="checkbox"/> Stratus <input type="checkbox"/> Nimbostratus	<input type="checkbox"/> Stratocumulus	<input type="checkbox"/> Cumulus <input type="checkbox"/> Cumulonimbus

Contrail Type (Record the number of each type observed)

Short-lived_____ Persistent Non-Spreading_____ Persistent Spreading_____

Cloud Cover (Check one- if sky not obscured)

☐ No Clouds ☐ Clear ☐ Isolated ☐ Scattered ☐ Broken ☐ Overcast ☐ Sky
(0%) (0% - 10%) (10% - 25%) (25% - 50%) (50% - 90%) (90% - 100%) obscured

Contrail Cover (Check one- if sky not obscured)

☐ None ☐ 0-10% ☐ 10-25% ☐ 25-50% ☐ >50%

If Sky Obscured (Check all that apply)

☐ Fog ☐ Smoke ☐ Haze ☐ Volcanic ash ☐ Dust ☐ Sand ☐ Spray ☐ Heavy rain
☐ Heavy snow ☐ Blowing snow

Barometric Station Pressure

Barometric Station Pressure (mbar): _____

Local Time (hour:min)* _____

Universal Time (hour:min)* _____

* If different from other measurements

Relative Humidity

Dry bulb temperature* (°C): _____

(note: Current air temp. and dry bulb temp. should be similar)

Wet bulb temperature* (°C): _____

* Sling Psychrometer only.

Relative Humidity (%): _____

School Name _____ Study Site: ATM- _____

Rainfall

Number of days rain has accumulated: _____

Rainwater in rain gauge (mm)*: _____

**Remember: enter 0.0 when there has been no rainfall.*

Record M for missing if there was rain and you weren't able to take an accurate reading.

Record T for trace if the amount of rainfall is less than 0.5 mm.

Snowfall

Daily: Number of days snow has accumulated on the snowboard: _____

Depth of new snow on the snowboard* (mm):

Sample 1: _____ Sample 2: _____ Sample 3: _____

Total: Total snow accumulation on the ground (mm):

Sample 1: _____ Sample 2: _____ Sample 3: _____

Rain equivalent of:

1. New snow on the snow board (mm): _____ 2. Total snowpack on the ground (mm): _____

** Remember: Record 0 when there has been no snowfall.*

Record M for missing if there was snow and you weren't able to take an accurate reading.

Record T for trace amount of snowfall (too small to measure).

Precipitation pH

Measurement method for pH: ☐ paper ☐ pen ☐ meter

pH of the rain or melted snow:

Sample 1: _____ Sample 2: _____ Sample 3: _____ Average: _____

pH of the melted snow pack:

Sample 1: _____ Sample 2: _____ Sample 3: _____ Average: _____

Maximum, Minimum, and Current Temperatures

Current air temperature: (°C) _____

Maximum daily air temperature: (°C) _____

Minimum daily air temperature: (°C) _____

Current soil temperature: (°C)* _____

Maximum daily soil temperature: (°C)* _____

Minimum daily soil temperature: (°C)* _____

**Note: Daily soil temperature measurements apply to those using a digital max/min thermometer with a soil probe.*

Comments (Unusual conditions):

Atmosphere Investigation

Integrated 7-Day Data Sheet

School Name _____ Study Site: ATM- _____

Day of the week							
Date							
Local time (hour:min)							
Universal time (hour:min)							
Observer names							

Cloud Type (Check all types seen)

Cirrus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Altostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alto cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nimbostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulonimbus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Type (Record the number of each type observed)

Short-lived							
Persistent Non-Spreading							
Persistent Spreading							

Cloud Cover (Check one- if sky not obscured)

No clouds (0%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clear (0% - 10%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Isolated (10% - 25%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scattered (25% - 50%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broken (50% - 90%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overcast (90% - 100%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sky obscured	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Cover (Check one- if sky not obscured)

None	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0-10%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10-25%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25-50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
>50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

School Name _____ Study Site: ATM- _____

If Sky Obscured (Check all that apply)

Fog	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smoke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Haze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcanic ash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dust	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spray	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy snow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blowing snow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Barometric Station Pressure

Station Pressure (mbar)							
Local Time (hour: min)*							
Universal Time (hour: min)*							

* If different from other measurements

Relative Humidity

Dry bulb temperature (°C) - Sling Psychrometer							
Wet bulb temperature (°C) - Sling Psychrometer							
Relative humidity (%)							

Rainfall

Number of days rain has accumulated							
Rainwater in rain gauge (mm)*							

* Remember: Record 0.0 when there has been no rainfall.

Record M for missing if there was rain and you weren't able to take an accurate reading.

Record T for trace if the amount of rainfall is less than 0.5 mm.

Solid Precipitation

Total snowpack on the ground:

Depth sample 1 (mm)							
Depth sample 2 (mm)							
Depth sample 3 (mm)							

School Name _____ Study Site: ATM- _____

Solid Precipitation (continued)

New snow on the snowboard:

Number of days snow has accumulated on the snowboard:							
Depth sample 1 (mm)*							
Depth sample 2 (mm)*							
Depth sample 3 (mm)*							

Rain Equivalent:

Rain equivalent of new snow on the snowboard (mm)							
Rain equivalent of total snow-pack on the ground (mm)							

* Remember: Record 0 when there has been no snowfall.

Record M for missing if there was snow and you weren't able to take an accurate reading.

Record T for trace amount of snowfall (too small to measure).

Precipitation pHMeasurement method for pH: ☐ paper ☐ pen ☐ meter

pH of the rain or melted snow:

pH sample 1							
pH sample 2							
pH sample 3							
Average							

pH of the melted snowpack:

pH sample 1							
pH sample 2							
pH sample 3							
Average							

Maximum, Minimum, and Current Temperatures

Current air temperature: (°C)							
Maximum daily air temperature: (°C)							
Minimum daily air temperature: (°C)							
Current soil temperature: (°C)*							
Maximum daily soil temperature: (°C)*							
Minimum daily soil temperature: (°C)*							

*Note: Daily soil temperature measurements apply to those using a digital max/min thermometer with a soil probe.

Add Comments on the back of this sheet: (Unusual conditions - date your comments)

Atmosphere Investigation

Ozone Data Sheet

School Name _____ Study Site: ATM- _____

Day of the week							
Date							
Observer names							

Ozone Strip Exposed

Local time (hour:min)							
Universal time (hour:min)							
Wind direction (N, NE, E, SE, S, SW, W, NW)							
Use values reported on Atmosphere Data Entry for clouds, contrails, current temperature, and relative humidity (Check the box)							
Current temperature (°C)							
Dry bulb temperature (°C) - Sling Psychrometer							
Wet bulb temperature (°C) - Sling Psychrometer							
Relative humidity (%)							

Ozone Strip Read

Local time (hour:min)							
Universal time (hour:min)							
Ozone concentration* (parts per billion)							
Wind direction (N, NE, E, SE, S, SW, W, NW)							
Current temperature (°C)							
Dry bulb temperature (°C) - Sling Psychrometer							
Wet bulb temperature (°C) - Sling Psychrometer							
Relative humidity (%)							

**Remember: enter M if the chemical strip gets damaged by snow or rain, or the response of the chemical is marbled.*

Comments:

School Name _____ Study Site: ATM- _____

Ozone Strip Exposed Cloud Data

Day of the week							
Date							

Take cloud data from ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Atmosphere Data Work Sheet

Cloud Type (Check all types seen)

Cirrus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Altostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alto cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nimbostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulonimbus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Type (Record the number of each type observed)

Short-lived							
Persistent Non-Spreading							
Persistent Spreading							

Cloud Cover (Check one- if sky not obscured)

No clouds (0%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clear (0% - 10%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Isolated (10% - 25%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scattered (25% - 50%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broken (50% - 90%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overcast (90% - 100%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sky obscured	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Cover (Check one- if sky not obscured)

None	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0-10%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10-25%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25-50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
>50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

School Name _____ Study Site: ATM- _____

If Sky Obscured (Check all that apply)

Fog	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smoke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Haze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcanic ash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dust	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spray	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy snow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blowing snow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ozone Strip Read Cloud Data

Day of the week							
Date							

Cloud Type (Check all types seen)

Cirrus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Altostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alto cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nimbostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulonimbus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Type (Record the number of each type observed)

Short-lived							
Persistent Non-Spreading							
Persistent Spreading							

School Name _____ Study Site: ATM- _____

Cloud Cover (Check one- if sky not obscured)

No clouds (0%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clear (0% - 10%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Isolated (10% - 25%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scattered (25% - 50%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broken (50% - 90%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overcast (90% - 100%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sky obscured	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Cover (Check one- if sky not obscured)

None	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0-10%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10-25%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25-50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
>50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If Sky Obscured (Check all that apply)

Fog	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smoke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Haze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcanic ash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dust	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spray	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy snow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blowing snow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Atmosphere Investigation

Aerosol Data Sheet

School Name _____ Study Site: ATM- _____

Date on which these measurements were taken (not necessarily today's date!): _____

Observer names: _____

Measurement Number	Local Time (hrs:min:sec)	Universal Time* (hrs:min:sec)	Maximum Sunlight Voltage* (volts)	Dark Voltage* (volts)	AOT (from GLOBE)
1* (green)					
1* (red)					
2* (green)					
2* (red)					
3* (green)					
3* (red)					
4 (green)					
4 (red)					
5 (green)					
5 (red)					

*Three measurements of each channel are required: you can report additional measurements if you like.

Cloud Type (Check all types seen)

Cirrus	<input type="checkbox"/>
Cirrostratus	<input type="checkbox"/>
Cirrocumulus	<input type="checkbox"/>
Altostratus	<input type="checkbox"/>
Alto cumulus	<input type="checkbox"/>
Stratus	<input type="checkbox"/>
Stratocumulus	<input type="checkbox"/>
Cumulus	<input type="checkbox"/>
Nimbostratus	<input type="checkbox"/>
Cumulonimbus	<input type="checkbox"/>

Contrail Type (Record the number of each type observed)

Short-lived _____
Persistent Non-Spreading _____
Persistent Spreading _____

Cloud Cover (Check one- if sky not obscured)

No clouds (0%)	<input type="checkbox"/>
Clear (0% - 10%)	<input type="checkbox"/>
Isolated (10 - 25%)	<input type="checkbox"/>
Scattered (25% - 50%)	<input type="checkbox"/>
Broken (50% - 90%)	<input type="checkbox"/>
Overcast (90% - 100%)	<input type="checkbox"/>
Sky Obscured	<input type="checkbox"/>

Contrail Cover (Check one- if sky not obscured)

None	<input type="checkbox"/>
0-10%	<input type="checkbox"/>
10-25%	<input type="checkbox"/>
25-50%	<input type="checkbox"/>
>50%	<input type="checkbox"/>

School Name _____ Study Site: ATM- _____

Sky Obscured

Fog	<input type="checkbox"/>
Smoke	<input type="checkbox"/>
Haze	<input type="checkbox"/>
Volcanic ash	<input type="checkbox"/>
Dust	<input type="checkbox"/>
Sand	<input type="checkbox"/>
Spray	<input type="checkbox"/>
Heavy rain	<input type="checkbox"/>
Heavy snow	<input type="checkbox"/>
Blowing snow	<input type="checkbox"/>

Sky Color

Deep blue	<input type="checkbox"/>
Blue	<input type="checkbox"/>
Light blue	<input type="checkbox"/>
Pale blue	<input type="checkbox"/>
Milky	<input type="checkbox"/>

Sky Condition

Unusually clear	<input type="checkbox"/>
Clear	<input type="checkbox"/>
Somewhat hazy	<input type="checkbox"/>
Very hazy	<input type="checkbox"/>
Extremely hazy	<input type="checkbox"/>

Sun photometer serial number: _____

Describe conditions that might affect sky clarity, such as urban smog, smoke from forest fires, or dust from agricultural activities:

Current air temperature: _____ °C Barometric station pressure: _____ mbar

Comments (Metadata):

Atmosphere Investigation

Clouds 7-Measurement Data Sheet

School Name _____ Study Site: ATM- _____

Day of the week							
Date							
Local time (hour:min)							
Universal time (hour:min)							
Observer names							

Cloud Type (Check all types seen)

Cirrus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cirrostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Altostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alto cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nimbostratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stratocumulus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cumulonimbus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contrail Type (Record the number of each type observed)

Short-lived							
Persistent Non-Spreading							
Persistent Spreading							

Cloud Cover (Check one- if sky not obscured)

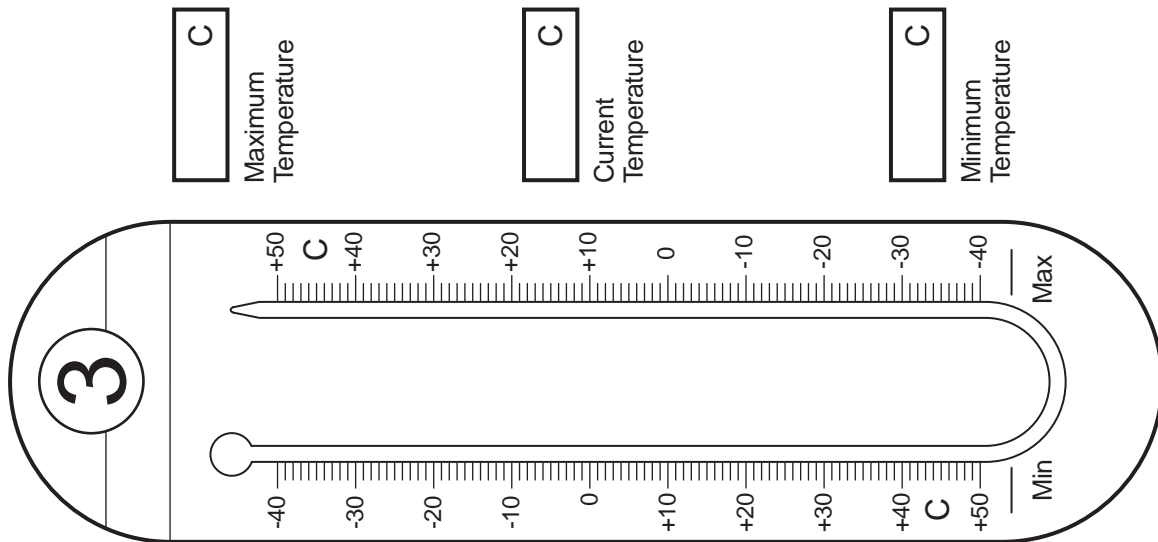
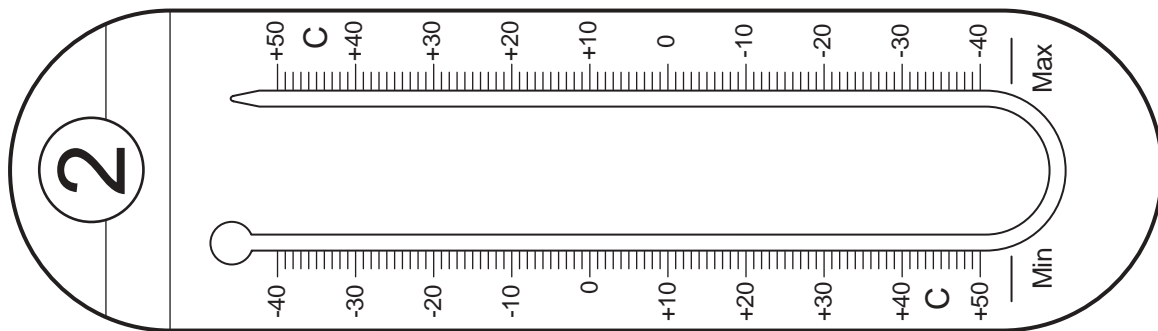
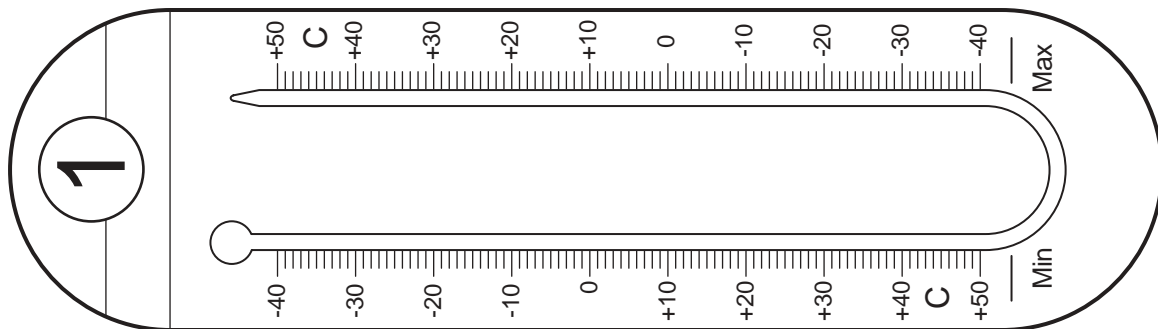
No clouds (0%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clear (0% - 10%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Isolated (10% - 25%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scattered (25% - 50%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broken (50% - 90%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overcast (90% - 100%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sky obscured	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

None							
0-10%							
10-25%							
25-50%							
>50%							

[illegible]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Maximum/Minimum Thermometer Work Sheet



Observing Cloud Type

There are five descriptive terms for the various types of clouds:

CIRRO or high clouds

ALTO or middle clouds

CUMULUS or white puffy clouds

STRATUS or layered clouds

NIMBUS or clouds from which precipitation is falling

The following ten types of clouds, named using the above terms, are to be used when reporting the cloud type for your area:



High Clouds

Cirrus

These clouds look like white delicate feathers. They are generally white wispy forms. They contain ice crystals.



Cirrocumulus

These clouds are thin white layers with a texture giving them the look of patches of cotton or ripples without shadows. They contain primarily ice crystals and perhaps some very cold water droplets.



Cirrostratus

These clouds are a thin, almost transparent, whitish layer made up of ice crystals. They may totally or partly cover the sky and can create a halo appearance around the sun.



Contrails

Short-lived Contrail

Note the short line of cloud above the lightpole. The airplane is barely visible in this photo but is at the front of the contrail



Persistent Contrails

These are very distinct contrails, and show a range from persistent non-spreading on the right to persistent spreading on the left. The most likely explanation for this photo is that all three airplanes followed about the same path, but that the winds high in the atmosphere are blowing from right to left, moving the older contrails to the left. The spreading of the left-most contrail indicates there is a fair amount of water vapor in the upper atmosphere.



Persistent, Spreading Contrails

This photo shows persistent, spreading contrails in an area of high air traffic. As above, it is likely that the planes are mostly following a similar path, but the contrails are being spread out by the wind. Note that all the contrails in this photo appear as wide or wider than those above, indicating that the presence of abundant water vapor in the atmosphere is allowing the contrails to spread. Also note the cloud near the middle of the photo, which looks like a regular cirrus cloud, but whose position makes it likely that this cloud actually originated from a contrail.



Middle Clouds

Altostratus

These clouds form a bluish or grayish veil that totally or partially covers the sky. The light of the sun can be seen through them but there is no halo effect.



Altocumulus

These clouds look like waves of the sea with white and gray coloring and shadows. They contain mostly water droplets and perhaps some ice crystals.



Low Clouds

Stratus

These clouds are gray and lie very close to the surface of the Earth. They usually look like a sheet layer but sometimes are found in patches. They rarely produce precipitation.



Stratocumulus

These clouds are a gray or whitish color. The bases of these clouds tend to be more round than flat. They can be formed from old stratus clouds or from cumulus clouds that are spreading out. Their tops also tend to be mostly flat.



Nimbostratus

This is a very dark and gray-colored cloud layer that blots out the light of the sun. It is massive and has a continuous fall of precipitation.



Cumulus

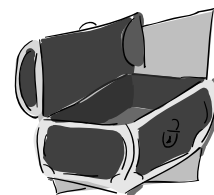
These clouds have a flat base and a dense, mound-shaped top that resembles a large cauliflower. Where the sun hits these clouds they are a brilliant white. The base tends to be a darker gray. They generally do not produce precipitation.



Cumulonimbus

These are large, heavy, and dense clouds. They have a generally flat, dark surface with very tall and large tops like the shape of a massive mountain or anvil. These clouds are often associated with lightning, thunder and sometimes hail. They may also produce tornados.

Glossary



Absolute Zero

The theoretical temperature at which matter has the least energy; the limit of how cold matter can get. If substances could be cooled to absolute zero they would not emit any electromagnetic radiation.

Absorption

Radiation retained by an object and converted to other forms of energy.

Acid Rain

Rain having a pH lower than 5.6, the pH of water in equilibrium with the current concentration of carbon dioxide in the air.

Aerosols

Liquid or solid particles suspended in the atmosphere. Their sizes generally have linear dimensions in the range of 100-1000 nanometers (nm).

Air Mass

A large volume of air (often covering thousands of square kilometers) with temperature and humidity characteristics that vary little horizontally.

Albedo

The percentage of incoming radiation (usually visible light) reflected back to space from a planet or object, its surface, or its cloud layers.

Altimeter

A barometer, normalized to standard pressure, temperature and density, used to measure altitude by measuring atmospheric pressure. Altitude is determined by assuming all changes in pressure are due to a change in height relative to sea level. Altimeters are adapted to work over wide ranges of height above sea level and used in GLOBE to measure barometric pressure at elevations above 500 meters.

Ambient Air

Air that is moving freely and not part of a specific perturbation to the surrounding atmosphere (e.g., not part of an exhaust plume, not smoke from a fire, not a dust cloud blown off a field).

Atmospheric Greenhouse Effect

Warming of a planet by the atmospheric absorption and re-emission of infrared radiation emitted from the surface of the planet by various gases in the atmosphere (i.e., *greenhouse gases*).

Barometer

An instrument used to measure atmospheric pressure.

Biological Diversity (biodiversity)

The variety of life in all its forms, levels and combinations that coexist in an ecosystem. At different scales this includes ecosystem diversity, species diversity, and genetic diversity. The degree of biodiversity is often used as an indicator of the health of the environment.

Blowing Dust

Dust (soil particles smaller than sand) suspended in the air that reduces visibility, or obscures part or all of the sky.

Blowing Sand

Sand suspended in the air that reduces visibility, or obscures part or all of the sky.

Blowing Snow

Snow from the ground that the wind blows into the air that reduces visibility, or obscures part or all of the sky.

Carbon Monoxide

Chemical compound of one oxygen atom and one carbon atom primarily produced as product of incomplete combustion. (chemical symbol: CO)

Ceiling

The height of the base of the cloud layer that covers more than 50% of the sky.

Ceilometer

An instrument used to determine the height of the cloud base, which helps to indicate cloud type.

Celsius Scale

A temperature scale invented in 1742 by Swedish astronomer Anders Celsius. This scale defines the melting point of water ice as 0° C, and the boiling point of water as 100° C. Because of the 100-degree interval



between these two points, this scale is sometimes called the “centigrade scale”.

Chemical Test Strip

A piece of paper treated with special chemicals that show a color change when exposed to ozone.

Cirriiform

A cloud type formed of ice crystals at high altitudes (greater than 6 km above sea level).

Climate

Weather at a locality averaged over some time period, plus extremes in weather behavior during a time period.

Cloud Cover

The percent of the sky covered by clouds.

Compounds

Chemicals made of atoms from two or more elements.

Concentration

The number of molecules of a specific gas in a unit volume relative to the sum of all the molecules in that volume, often reported as parts per million (ppm) or parts per billion (ppb).

Condensation

The change of phase of a substance from a vapor to a liquid. The process of condensation releases energy; this energy is known as latent heat.

Conduction

The transfer of heat through collisions of the individual constituents of a substance (e.g., molecules, atoms) without the systematic movement of groups of these constituents. For example, if one end of a metal rod is heated, the heat will be conducted the length of the rod so that the other end will also increase in temperature. Conduction can occur in solids, liquids, or gases (but is generally most efficient in solids).

Convection

The transfer of heat by mass flow, that is, large scale motion within a liquid or a gas of groups of constituents (e.g. molecules, atoms) that are relatively warmer or

cooler than their surroundings. In the atmosphere convection mostly refers to vertical motions brought about by warm air rising and cooler air sinking.

Cumuliform

A cloud type that is heaped, puffy, banded, or otherwise is characterized by rounded features particularly on the top and sides.

Density (D)

The ratio of the mass (M) of a substance to its volume (V) ($D = M/V$)

Deposition

The process by which water vapor turns directly into ice on a surface without passing through the liquid phase.

Dew Point Temperature

The temperature at which the water vapor begins to condense in air cooled at constant pressure. Dew Point Temperature is a measure of the amount of water vapor in air.

Diffuse Insolation

Solar radiation that reaches Earth's surface by being scattered or reflected by components of Earth's atmosphere (such as gases, clouds and aerosols).

Direct Insolation

Solar radiation that reaches Earth's surface by passing directly through the atmosphere without interacting with the components of Earth's atmosphere.

Diurnal Cycle

Refers to the 24 hours of the day, and sometimes the changes that occur over that 24-hour time period.

Drizzle

Slow falling liquid precipitation made up of droplets with diameters between 0.2 and 0.5 mm. Drizzle reduces visibility more than light rain because of the large numbers of very small drops.

Dry Bulb Temperature

The temperature on one of two thermometers on a sling psychrometer; this temperature corresponds to the bulb which does not contain the water saturated wick



Ecosystem

A community of different species interacting with one another and with the chemical and physical factors making up their surroundings.

El Niño

El Niño refers to a prolonged significant warming of surface waters in the central and eastern tropical Pacific Ocean and generally to the phenomena that accompany this warming.

Electromagnetic (EM) Radiation

Energy waves produced by oscillating or accelerating electric charges. EM waves have both electric and magnetic components. Unlike conduction and convection, EM waves do not need media like solids, liquids, or gases in order to transfer energy. Electromagnetic radiation can be arranged in a spectrum from very energetic short wavelengths (gamma rays, x-rays), to less energetic, very long wavelengths (microwaves and radio waves). Visible light is a small part of the electromagnetic spectrum that human eyes can see.

Elevation Angle

The angular distance between the horizon and an object in the sky, such as the sun. The *zenith angle* is 90° minus the elevation angle.

Evaporation

The phase change of a substance from a liquid to a gas.

Evapotranspiration

The transfer and transformation of liquid water from soil to air by the combined processes of evaporation and transpiration by vegetation.

Fahrenheit Scale

A temperature scale invented by the 18th century German physicist Daniel Gabriel Fahrenheit. This scale defines the melting point of water ice as 32°F and the boiling point of water as 212°F . The United States is the only major country in the world still commonly using the Fahrenheit scale.

Fog

A cloud in contact with Earth's surface.

Force (F)

a push or pull

Freezing

The process of water changing phase from liquid to solid (ice)

Freezing Rain and Freezing Drizzle

Supercooled water drops that freeze when they come in contact with cold surfaces.

Front

The narrow transition region between two distinct air masses. A front is a region of changing wind direction, changing surface air pressure, and often results in the development of clouds and precipitation.

Frost

The deposition of ice from water vapor in the atmosphere directly onto surfaces such as grass or windows.

Geostationary

An object in orbit around Earth that stays above a certain location on the planet; the object is generally located directly above the Equator at a fixed longitude.

Greenhouse Gas

Any gas that causes heat to be retained in the atmosphere and thereby causes the average temperature of the atmosphere to increase. Greenhouse gases are strong absorbers of infrared radiation. Examples of significant greenhouse gases are water vapor, carbon dioxide, nitrous oxide, methane, and chlorofluorocarbons.

Gravity

The force of attraction among all matter (e.g., gravity pulls each of us toward Earth's center).

Greenwich Mean Time (GMT)

The same reference time as Universal Time (UT); the time at 0 degrees longitude (the prime meridian) that passes through Greenwich, England.

Hail (also known as Hailstones)

Precipitation in the form of irregular balls of ice ranging in size from about 2 mm to 13 cm in diameter. The largest hailstones can only form in the most violent thunderstorms that have extremely strong updrafts (upward moving air).

**Halo**

The optical phenomenon caused when sunlight or moonlight is refracted through ice crystals, splitting the visible beam into its distinct colors. This occurs only with cirrostratus or thick cirrus clouds.

**Haze**

The reduction of visibility by aerosols in the atmosphere. Haze may cause the sky to appear milky white to yellowish, reddish, or brown, depending on whether the aerosol is wet or dry and depending on the size and nature of the particles which scatter the light.

**Heat**

The total energy of motion of all of the atoms and molecules that make up a substance.

**Heavy Rain**

Rain falling at such a great rate (greater than 7.5 mm/hr) that it reduces visibility and obscures the view of the sky.

Heavy Snow

Falling snow that reduces visibility to less than 400 meters and obscures the view of the sky.

**Hydrocarbons**

Compounds composed primarily of carbon and hydrogen atoms. Gaseous hydrocarbons occur in the atmosphere, (e.g., the compounds in natural gas, chemical species given off naturally by plants, and compounds that result from by-products of the combustion process).

**Hydrologic Cycle**

The continuous flow of water through the Earth system. The hydrologic cycle is composed of reservoirs of water (such as ice caps, oceans, atmospheric humidity, and aquifers) and fluxes or flows of water (such as evaporation, precipitation, river flow, and iceberg calving).

**Hygrometer**

An instrument used to measure the relative humidity of air.

Ice Pellets

Same as sleet.

Infrared radiation

Light (electromagnetic radiation) with wavelengths ranging from just longer than visible light (0.7 micrometers) to just shorter than microwaves or radio waves (1000 micrometers). The amount of light thermally emitted by Earth's surface and lower atmosphere peaks at wavelengths near 10 micrometers, and light in this portion of the infrared wavelength range is often referred to as thermal infrared.

In situ

In place. Most of the atmospheric measurements in GLOBE, such as temperature and ozone, are taken *in situ*; however, many of these quantities can also be measured *remotely* through the use of special satellites.

Insolation

Incoming solar radiation.

Interplanetary Medium

The space between the planets that contains electromagnetic radiation, electric and magnetic fields, ionized gas, neutral atoms, and microscopic dust particles. The characteristics of interplanetary space are primarily influenced by the sun and not by individual planets.

Inverse Relationship

When two variables are related to each other in an opposite way; for example, as one increases, the other decreases (e.g. $x = 1/y$)

Isobars

Lines on a map connecting points of equal pressure.

Isotherms

Lines on a map connecting points of equal temperature.

Kelvin Scale

A temperature scale named for British physicist William Thomson Kelvin who proposed it in 1848. One Kelvin degree is equivalent to one Celsius degree. However, zero on the Kelvin scale is defined to be the temperature at which molecular energy is a minimum, also called "absolute zero". The convention when writing temperatures in the Kelvin

scale is to just use the letter K, omitting the degree symbol. Zero on the Kelvin scale corresponds to approximately -273°C .

La Niña

A period of anomalous cooling of sea-surface temperatures in the central and eastern tropical Pacific Ocean.

Latent heat

The heat used or released when water changes phase between solid, liquid, and gas.

Melting

The process of a substance changing phase from solid to liquid.

Mesosphere

The third layer of the atmosphere above Earth's surface, generally found between altitudes of 50 km and 80–85 km and characterized by temperature decreasing with altitude.

Millibar

A unit of barometric pressure equivalent to one one-thousandth of a bar and equivalent to a hectopascal.

Mixing Ratio

A scientific term often used synonymously with concentration. One example is the mass of water vapor in a sample of air divided by the total mass of air in the sample.

Nitrogen Oxides

The family of compounds comprised of one or more nitrogen atoms and one or more oxygen atoms. Nitric oxide (NO) and Nitrogen dioxide (NO_2) are both primarily products of combustion whereas nitrous oxide (N_2O) is a primarily product of microbial activity in soils.

Optical thickness (also optical depth)

A measure of how much particles (aerosols) and gas molecules (air) impede the transmission of light through a gas at a specific wavelength. At an optical depth of one, the incoming light is attenuated to $1/e$ in intensity.

Ozone

A highly reactive gas composed of 3 oxygen atoms that exists in varying

amounts in the troposphere and stratosphere. Ozone is found naturally in the atmosphere as a result of breaking apart oxygen molecules (O_2) into two oxygen atoms that combine with molecules of oxygen to form ozone (O_3).

Ozone Layer

The layer of the atmosphere in the stratosphere and lower mesosphere that absorbs most incoming ultraviolet radiation.

Ozone Optical Scanner

An instrument used in GLOBE's ozone protocol that measures the color change on the chemical test strips and interprets this change as an ozone concentration in units of ppb.

Pascal

The unit of pressure equivalent to 1 Newton/meter-squared. 100 pascals equals one hectopascal which is a standard pressure unit used in GLOBE.

pH Scale

The system used to specify the range of acidity or alkalinity of substances. On this scale, a substance with a pH of 7 is neutral. Substances with pH less than 7 are acidic; substances with pH greater than 7 are alkaline (or basic).

Phase Change

The change in a substance from one phase to another. Substances (elements and compounds) generally exist in one of three phases solid, liquid, and gas; For example, water vapor (gas) condensing into water (liquid). Substances undergoing phase changes take up or give off heat without changing temperature. (See Latent Heat.)

Photolysis

The break-up of an atmospheric compound by light. For example, when ozone (O_3) is formed in the atmosphere, it can be split into atomic oxygen (O) and molecular oxygen (O_2) by ultraviolet sunlight.

Polar-Orbiting Satellite

An artificial satellite (spacecraft that orbits Earth) passing near or over the poles. This term usually refers to satellites in near-



polar orbits that are designed so that their orbital plane maintains a constant angle (on average) with the line between the sun and Earth. These are called sun-synchronous satellites.

Pollutant

A trace gas or aerosol that contaminates the air.

ppb

Parts per billion, a unit of measure of atmospheric trace gas concentration or mixing ratio; sometimes denoted ppbv (parts per billion by volume), which is how trace gas mixing ratios are normally defined.

Precipitable Water Vapor

The depth of a planet-wide layer of liquid water that would be formed if all the water vapor in a column of atmosphere were condensed onto Earth's surface. On average, the atmosphere contains about 2 centimeters of precipitable water vapor.

Precipitation

Water in solid or liquid form that falls to Earth's surface from the atmosphere.

Precursor

A chemical necessary to reactions that form other compounds (e.g., nitric oxide is a precursor of ozone in the near-surface atmosphere)

Pressure

Force per unit area; for the atmosphere, it may be thought of as the weight of the column of air above a given area.

Radiation

See "*Electromagnetic Radiation*".

Rayleigh scattering

Scattering of sunlight by molecules in the atmosphere, named after the 19th century British physicist John William Strutt, the third Baron Rayleigh.

Reactive Chemicals

Chemicals that will undergo chemical reactions in the atmosphere.

Reflection

The process by which radiation incident upon an object is directed at some fixed angle away from that object.

Relative Air Mass

The ratio of the amount of atmosphere between an observer and the sun relative to the amount of atmosphere directly overhead. Relative air mass is directly related to solar elevation angle.

Relative Humidity

A measure of the amount of water vapor in a sample of air compared to the amount contained in an air sample at the same pressure and temperature saturated with water vapor.

Satellite

An object in orbit around a larger celestial body.

Scattering

The process by which radiation interacting with a substance is deflected in all directions.

Sea Level Pressure

Atmospheric pressure adjusted to the value that would be measured if the measurement location were at sea level.

Sea Spray

Aerosols blown off the surface of a salt water body under windy conditions, which may produce obstructions to visibility.

Seasonal Cycle

A periodic change in a variable that occurs in tandem with Earth's seasons

Sensible Heat

The heat associated with a change in temperature of a substance as distinct from the heat associated with a phase change.

Shower

A type of precipitation event that is typically of short duration, or occurs with frequent changes of intensity.

Sleet

Precipitation that at some point is in liquid form, but freezes before reaching the ground.

Sling Psychrometer

A device consisting of two thermometers, one of which has a dry bulb and the other of which has a bulb that is kept wet. The



difference between the wet and dry bulb temperatures is used to calculate relative humidity.

Smog

Air that contains a sufficient combination of aerosols from water and combustion to be visible. Aerosols in smog may be produced indirectly by reactions among the gases present in combustion exhaust. Smog originated as a term combining the words smoke and fog and may reduce visibility in a similar way.

Smoke

Air containing sufficient aerosols produced by combustion to be visible, which may reduce visibility or obstruct views of the sky.

Solar Noon

The time at which the sun is at its highest point in the sky (zenith) during a day.

Specific Heat

The amount of heat required to raise the temperature of 1 gram of a substance by 1° C.

Squall

An intense or violent shower accompanied by strong, gusty winds.

Station Pressure

The true atmospheric pressure, uncorrected to standard conditions at sea level. Weather reports generally give barometric pressure corrected to sea level, not station pressure.

Stratiform

A cloud comprised of a single or multiple horizontal layers; there is very little discernible structure to clouds of this type.

Stratosphere

The second layer of the atmosphere above Earth's surface, generally characterized by temperature increasing with altitude. The stratosphere begins at altitudes ranging from about 8 km in the polar regions to 1618 km in the tropics and extends to altitudes of about 50 km where there is a local maximum in atmospheric temperature. The stratosphere contains most of the ozone found in the atmosphere.

Sublimation

The transition of a substance directly from the solid phase to the gas phase.

Sun Photometer

An instrument that measures the intensity of sunlight transmitted through the atmosphere within a narrow wavelength range.

Supercooled Water

Water with a temperature that is below its freezing point but still in liquid form.

Temperature

A measure of the *average* energy of motion of all the atoms and molecules that make up a substance.

Temperature Inversion

An increase in temperature with height in the troposphere, usually associated with a very stable air mass. Normally, temperature in the troposphere increases with height. When and where temperature increases with height, vertical mixing of the atmosphere is greatly decreased. This leads to the trapping of aerosols and trace gases from the surface being contained in the air near the surface. It also causes the atmosphere to be stratified in horizontal layers in the stratosphere, hence the name of this atmospheric layer.

Thermosphere

The fourth layer of the atmosphere above Earth's surface. In the thermosphere, temperature increases greatly, ion concentrations become significant, and the dynamics of the atmosphere is virtually independent of the forces and phenomena associated with Earth's surface and lower atmosphere. Most of the ionosphere is contained within the thermosphere and above the thermosphere is interplanetary space.

Thunderstorm

A cumulonimbus cloud or family of cumulonimbus clouds that produce lightning, and therefore, thunder. Thunderstorms are not always accompanied by precipitation reaching the ground.

**Trace Gas**

Gases present in the atmosphere in very small quantities, always less than one-tenth of one percent.

Transpiration

The process by which water vapor escapes into the atmosphere through open stomata on plant leaf surfaces.

Tropical Cyclone

A low pressure system found in tropical latitudes which may develop into a tropical storm, hurricane, and other similarly intense storm.

Troposphere

The lowest layer of the atmosphere where almost all weather occurs. The troposphere contains about 80% of the atmosphere's mass and is characterized by temperatures that normally decrease with altitude. The boundary of the troposphere and the stratosphere depends on latitude and season. It ranges from as low as 8 km over the poles to as high as 16-18 km in the tropics.

Ultraviolet

A part of the electromagnetic spectrum that is more energetic, and of shorter wavelengths than visible light; usually defined as radiation with wavelengths of 0.1 - 0.38 micrometers.

Universal Time (UT)

The time at 0 degrees longitude (the prime meridian); UT is the currently preferred term for this reference time, which is the same as GMT.

Visibility

The distance over which an observer can see and clearly identify an object.

Visible Radiation

Light with wavelengths between about 0.38 and 0.7 micrometers that may be seen by humans. The sun emits its peak amount of energy in the visible portion of the electromagnetic spectrum.

Volcanic Ash

Small particles of minerals, rock and glass fragments ejected from volcanic eruptions. As aerosols they may reduce visibility or

obscure a view of the sky. These particles often produce spectacular light scattering effects including colorful sunsets.

Water Cycle

See Hydrologic Cycle.

Water Vapor

The colorless, odorless, invisible, gaseous form of water in the atmosphere.

Wavelength (of light)

A property of light that is inversely proportional to its frequency and describes the distance from one wave peak to the following wave peak. Visible light lies in the wavelength range from about 0.38 micrometers (violet) to 0.7 micrometers (red). The peak sensitivity of the human eye is to light at a wavelength of about 0.5 micrometers (green), near the response wavelength of the green channel of the GLOBE sun photometer.

Weather

The state of the atmosphere at a particular place and time. Weather includes variables such as temperature, barometric pressure, wind, cloudiness, precipitation, and relative humidity.

Wet Bulb Depression

The difference between the dry bulb and wet bulb temperature readings on a sling psychrometer.

Wet Bulb Temperature

The temperature taken on a sling psychrometer from the thermometer with its bulb covered in a wet wick, after slinging or whirling the psychrometer for the prescribed amount of time.

Wet Deposition

The depositing of gases or aerosols from the atmosphere on to Earth's surface through their incorporation in precipitation (rain drops, snowflakes, etc.). Sometimes the terms 'rain out' or 'wash out' are used in place of wet deposition.

Zenith Angle

The angular distance between an object in the sky, such as the sun, and an object directly overhead. Zenith angle is 90° minus the *elevation angle*.

